IN THE UNITED STATES PATENT AND TRADEMARK OFFICE Cook et al. Patent Pending Serial No.: 10/647,420 Filed: August 25, 2003 For: A Method and Apparatus to Control Waste Toner Collection in an Image Forming Apparatus Attorney's Docket No: 2002-0848.02/4670-

Raleigh, North Carolina August 1, 2005

Mail Stop Amendment Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

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DECLARATION OF PRIOR INVENTION UNDER 37 C.F.R 1.131

We, William Paul Cook, Tom E Stickler, Larry Steven Foster, and David Erwin Rennick, inventors of the subject matter claimed in the above referenced application, hereby declare as follows:

- 1) We conceived an invention tentatively entitled "Waste Toner Handling," and prepared with due diligence an Invention Disclosure describing our invention not later than 14 April 2003. A partially redacted copy of the Invention Disclosure Addendum is attached as Exhibit 1.
- 2) We submitted the Invention Disclosure Addendum to the Lexmark
 Intellectual Property Law Department on 14 April 2003. Thereafter, we were contacted
 by the Intellectual Property Law Department and/or outside counsel that a United States

Patent application was to be prepared for this invention. This process included reviewing a draft copy of the application. We received a final copy of the patent application, which we reviewed, signed, and submitted to the Intellectual Property Law Department and/or outside counsel on 21 August 2003.

3) We were informed that the application was filed in the United States

Patent and Trademark Office on 25 August 2003.

We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

ang 2, 2005

11 AUG 2005 Date

Aug 2, 2005 Date

Hug 9, 2005 Date William Paul Cook

Tom E Stickler

Larry Steven Foster

David Erwin Rennick



Go to Original Invention Disclosure

Go to Technical Evaluation





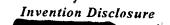
Lexmark Confidential							
LEXMARK.	Invention Disclosure Addendum Cover Sheet Status: Final		m	Disclosure Number: 2002-0848.00 Date Received: 04/14/2003 Docket Number: 2002-0848.02			
Inventor(s)	Serial #	Division	Department		Building	Location	Phone
Bill Cook	0909341	PSSD	501A48L	035-2		Lexington	859/232-6615
Tom Stickler	0369179	PSSD	501A43L	035-1		Lexington	859/232-7787
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Additional Inventors: Larry Steven	Foster, David	Erwin Rennick					
Title of the Invention							
Waste Toner Handling							
Product Code Name							
Product Code: Falcon Additional Product Codes:							

Title of the Invention				
Waste Toner Handling				
Product C	Product Code Name			
Product Code: Falcon Additional Product Codes:				
Reason for	Addendum			
Add claim for convenient external access at the side of the apparatus for operator removal and replacement of the waste toner container, add co-inventors for this claim.				
Sum	mary			
Evaluator: Deb MacKay	Attorney: John McArdle			
Inventor Signatures — Pursuant to the Agreement Regarding Confidential Information and Intellectual Property to which I have agreed, I hereby assign my entire right, title, and interest in this invention, and all U.S and foreign patent rights resulting therefrom, to Lexmark International, Inc.				
Signature of Inventor Date Jone Stubler 14 A PRIL 2003 Chan O Ellen 9 14 APR 2003	Signature of Inventor Date			
Vam Scat 15 APR 2003				
William Cook 4/15/03				
Witness Signatures — As a witness to this invention disclosure, I hereby confirm that I have read and understood this entire document as of the date indicated below.				
Signature of Witness Ban Date 4-15-03	Signature of Witness) Coule 4/16/13			
Lexmark C	Confidential EXHIBIT 1			

Tom Stickler--04/14/2003 11:08:42 AM

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(When Completed)



Full Name(s) of Inventor(s)	Emp. Serial	Div./Dep	Bldg, Zip	Location	Extension	FOR USE BY THE
William Paul Cook	909341	A48L	035-2	LEX	2-6615	INTELLECTUAL PROPERTY LAW DEPT.
Tom E Stickler	369179	A43L	035-1	LEX	2-7787	DISCLOSURE NO.
Larry Steven Foster	768082	A35L	035-2	LEX	2-7564	Where & When Received (TIME STAMP)
David Erwin Rennick	803423	A49L	035-2	LEX	2-4701	

Title of Invention (Short and Descriptive)

Waste Toner Handling

Problem Solved by this Invention (Summary)

A common waste toner handling system in an EP printer requires a means to move the toner from the cleaner blade on the photoconductor roll to a waste container, a means of spreading the toner throughout the container, as well as a means of detecting when the waste container is full. Novel means of spreading the waste, sensing the presence of the waste container and sensing a near full and completely full condition are disclosed.

INVENTION BACKGROUND

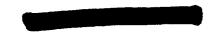
The capability of moving toner along a path using an auger is well known, as it takes advantage of the fluid flow properties of the toner. The waste material (toner, paper dust, etc.) may simply be pushed into an output container using the auger and/or gravity. If the output container is an integral part of the developer supply cartridge, it may not be necessary to pack the container efficiently or sense that the container is full, as a new cartridge will be installed when the fresh toner is depleted. However, the developer supply volume is greatly increased to accommodate the waste material, making the overall printer volume increase as well.

In a full color printer with several developers, a better solution is to provide a common container for the toner waste from all cartridges, and make the container a replaceable unit. In that case, it is necessary to pack the toner efficiently in the container and sense when the container is full. It would be optimal if a near full condition could be detected, to provide a warning to the user that the container will need to be replaced soon.

A simple design would utilize a separate motor on the waste container to spread and pack the toner, and a sensor of some type to detect the toner level within the container, such as an optical sensor.

Witnesses: The two witnesses whose signatures a have read and understand this entire invention d	ppear below isclosure.	DISCLOSURE SUBMITTED BY		
Signature of Witness	Date	Inventor's Signature Jon E Stubler	Date 14APR 03	
Daymon Joan 4	1-15-03	Inventor's Signature	Date 14 APR 03	
Signature of Witness	Date	Inventor's Signature	Date 15 APROT	
Come B. Clarke 4/	16/03	Inventor's Signature William Cook	Date 4/15/63	
A state of the sta		Inventor's Signature	Date	
V.		Inventor's Signature	Date	

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Invention Disclosure

INVENTION DESCRIPTION

The waste toner is driven through the cleaner assembly by an auger (not shown) to a port on the waste toner chute. A vertical auger within the chute drives the toner down to the waste toner container. An existing motor is used to auger the toner down from the four cartridges to the waste container and spread the toner within the container. The existing motor normally drives the align roller in the paper path below (before) the development stations. The align roller uses established technology to align the leading media edge by running in a reverse direction while the leading edge enters the roller nip to generate a slight bubble in the media, then running in the forward direction to push the media into the first development station. The forward movement of the align roller is critical to image registration on the media.

A toner rake is also shown, which is capable of spreading the toner evenly throughout the waste container. One end of the rake is attached off-center to a rotating gear, providing an oscillatory raking movement. The torque needed to move the toner within the waste container varies with the amount of toner. At first, very little is needed, as the toner simply falls through the rake to the bottom of the container. As the waste pile size increases, it reaches the rake, and the rake pushes the top of the pile toward the empty container volume. Very little torque is needed at the top of the stroke of the rake, as the rake should not touch the toner pile. A little more torque is required during the active rake motion as it pushes the pile, but the difference is not enough to sense consistently. Eventually the empty volume below the rake becomes filled with waste toner, and the rake begins compressing the toner during its forward motion, while pulling a little toner back during the reverse motion. The torque increases significantly during the forward motion, and can be detected consistently as a near-full condition. Finally, the waste toner level rises above the rake, and the motor torque increases during the entire movement, while the forward torque becomes very large as the rake pushes through compacted toner. This condition is also detectable as a separate full condition. The sensing means is a simple comparison of the necessary PWM output that controls the motor. A small PWM percentage is needed to turn the off-center gear at first, and larger values are needed as the container fills up. The PWM value when the container is empty is saved in engine memory for comparison with later values. The maximum and minimum PWM values during one raking cycle are both used to generate the near-full and full conditions.

Toner is received from the four cleaner assemblies, which contain internal augers to drive the toner. Toner falls down a port to a vertical auger (spiral conveyor) which drives the toner down to the waste collection container. A flexible flap, fixed at the top of each port, is agitated during each rotation of the auger, as the flap extends slightly into the shaft containing the auger. The resulting vibration keeps toner from sticking within the port. A spring-actuated shutter seals each toner entry port. The cleaner assembly pushes the entry shutter open when present in the printing position.

Witnesses: The two witnesses whose signatures appear below have read and understand this entire invention disclosure.	DISCLOSURE SUBMITTED BY		
Signature of Witness Date	Inventor's Signature Lam E Stutelly	Date 14APRO3	
(Jan 7-15-07	Inventor's Signature Lan DE Com	Date HAPRO3	
Signature of Witness Date	Inventor's Signature	Date 15 APRO3	
Crus B Clarke 4/16/03	Inventor's Signatuse William Cook	Date 4/15/03	
	Inventor's Signature	Date	
	Inventor's Signature	Date	

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	Because the torque to push the rake becomes the torque varies significantly during each ralign roll forward movement. A one-way cl stationary while the paper is pushed up through the toner when the align roll is running in revolute the actual travel distance is very small, toner evenly. Additional raking action is prefrom the input stack to the align roll, and respectively) and during transfer servo oper container level can only be tested while the rain, run-out, or extended gap periods. The vertice of the respectively was actionally well as the respectively of the respectively.	aking cycle, the rake movement is is allows the ugh the development stations, but engineerse. The reverse movement occurs do not providing enough raking action to rovided during run-in and run-out (mathematical from the development stations to the ations which extend the inter-page grake is in operation, so it can only be certical auger that pulls the toner down	olated from the rake to remain gages and rakes luring each gap, o distribute the edia movement e output stack, ap. The waste checked at runn from the four
	The waste container, replaced with a new, empty one. The container so the presence of the container itself must be motor speed) is used to sense that the container when the container is removed, and engages a fixed position. The motor will immediately torque condition with no motor movement. It walue is used as a container presence sensing at any time without damage to the machine, of the align roll is not impeded, so the media of the next sheet which was driven into the align returned to the input stack for operation to confit the vertical toner chute is sealed by rotations.	A similar torque sense system (PWM) er has been removed. The rake interled tooth on the rake drive gear, locking stall, if it is running in reverse, and The lack of motor movement, rather condition. Note that the container more even difficult paper jams. The forwaithin the paper path can be driven to n roll will probably need to be removed ontinue. When the waste box is absent	value at fixed ock arm rotates the gear into a d cause a high than the PWM ay be removed ward movement the output bin.
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l	Vitnesses: The two witnesses whose signatures appear below save read and understand this entire invention disclosure.	DISCLOSURE SUBMITTED I	ВҮ
S	ignature of Titness Date Date 775-63	Inventor's Signature Tom E Stuckler Inventor's Signature	Date 14APRO3 Date 14APRO3
Š	ignature of Witness Date	Inventor's Signature	Date 15 BPLUS
		Inventor's Signature	Date Date
		Inventor's Signature	Date